COTS in our Air Control System

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1 Abstract

A huge international project was launched in 1997 in Hungary: setting up an air control and sovereignty nationwide system based on former Soviet radars and American air sovereignty operations centre (ASOC).

The deadline was extremely short and the available funds low. The main strategy of the project was to use modular elements and commercial components as much as possible.

That is why we decided using PC-s (dual Pentium II class), Windows NT 4.0 operating system and Visual C++ developer system. Some part of hardware were developed using digital signal processors (TEXAS type). Our specialists and American collages worked hard and the American made ASOC centre and the Hungarian information system were used for military service in the fourth quarter of 1998. The system transmitted the radar (military and civil, primer and secondary) information automatically to ASOC in real time.

2 Antecedents of starting the program

In January of 1994 President Clinton suggested building-up a collective regional air control and sovereignty system covering four countries as an integral part of "Partnership for Peace" program on the summit conference of Visegrad countries, in Prague.

In January of 1995 the US Deputy Minister of Defense stated in Trencin (Slovakia) that, his government had accepted building up the system (it means 6.25 million USD for Hungary) after accomplishment of appropriate conditions. The Hungarian government accepted the proposal of USA government (building up ASOC in Hungary) and introduced to the Parliament for approval a resolution.

In September of 1995 The Parliament adopted a resolution (94/1995. OGY), developing of information and control radar system.

The Government of the Hungarian Republic agreed with the necessity of developing of information and control radar system, and assisted that Ministry of Defense to start development and procurement program of modern technical equipment for this action by international application.

The inter-governmental agreement about deployment of ASOC in Hungary (LOA) was signed at the end of 1996.

3 Antecedents of developing of air-defense information system serving Hungarian ASOC

The American-Hungarian professional conference defining connection of information sources to ASOC took place in July of 1997. In third quarter of 1997 establishment of ASOC home conditions could start. It was necessary to develop modern equipment agreed actual demands applying and modifying former developments' results, regarding actually measuring reports. The document named "Data sheet and basic requirements" was agreed on 30-th July in 1997. The Automation and Radar Department in the Institute of Military Technology prepared the "tactical-technical requirements", which contained Hungarian requirements. It is the first nation-wide system developed in International Co-operation.

For the proper operation of ASOC there was necessary radar information in plot- or track form to transfer in a defined protocol. There were many tasks in researching and developing (R&D) plan of the Institute of Military Technology falling on developing all system of military radar technology. Institute of Military Technology with civilian companies had many results in these developing tasks, but deploying ASOC system in Hungary had many new aspects of problems in communication protocol interface to the new centre.

3.1 What kinds of tasks had co-operative partners!

3.1.1 Tasks of the USA partner

- Deploying ASOC center (hardware, software) in Veszprém;
- Providing conditions for integrating Hungarian developed systems.

3.1.2 Tasks of the Hungarian partner

- Provide facilities for deployment of ASOC (room, communication, power supply);
- Provide communication systems for ASOC;
- Provide digitizer information sources (radar', flight plan);
- Getting air picture information by ASOC to users;
- Co-operation in integration of Hungarian developed equipment to ASOC system, together with domestic civilian companies.

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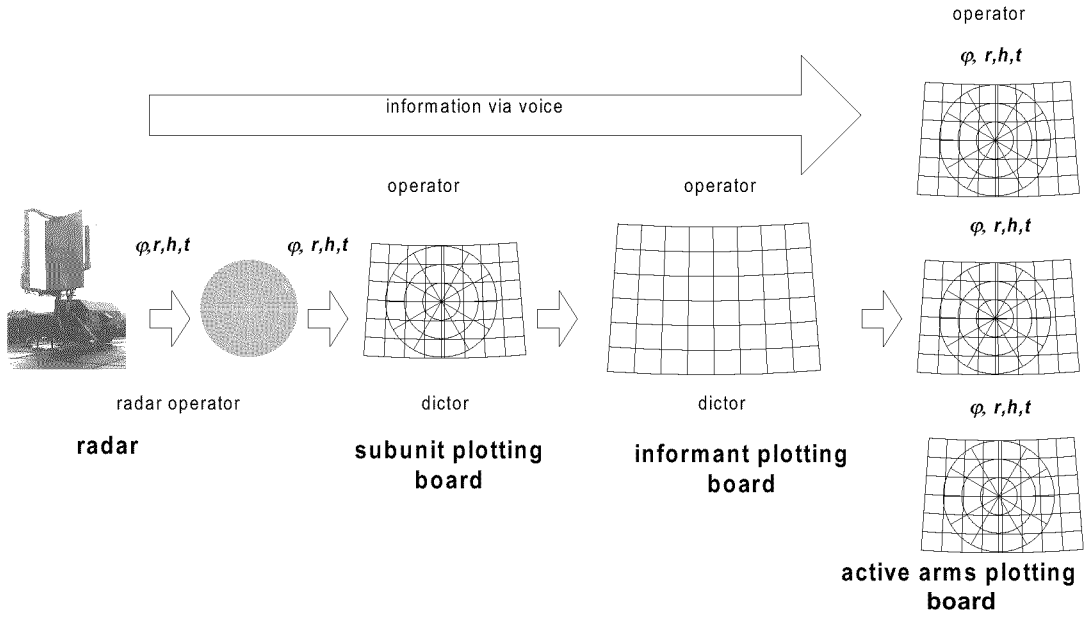
4 The tasks of the ASOC and the connected air traffic control system that was made according to the Hungarian Military Research and Development (R&D)

- Assuring the air sovereignty of the independent Hungarian Republic;
- Gathering information about the objects in the national air space (reconnaissance of the air targets and measure their location with radar's);
- Pre-processing of radar data for transmission (digitalisation, conversion of computer protocols);
- Providing the radar data for processing (sector center functions);
- Analysis and decision preparation (function that helps for the commander at the sector centre and the regional air sovereignty control centre)
- Transmission of target identifier to the active arms (transmission of the commands to the subordinates with displaying on the computer).

4.1 Radar information system before ASOC



Before setting up ASOC the information from radar site to the active arms was translated via voice.
It means that some soldiers dictated the data of flaying objects, others drew them on the plotting board.
The information flow was not too accurate, and was delayed 3 - 6 minute.

4.2 The national system's grouping by the tasks

Providing the different radars as information source

- Civil radars (long-range radar and short-range radar), primary and secondary plot information transmission to the ASOC;
- Military radar's' primary and secondary plot information transmission to the ASOC;
- Flight data plan (civil and military) transmission to the ASOC.

Accept the air traffic picture made by the ASOC

- Displaying the air position at the active arms;
- Transmission the target identifying directive of the commander's.

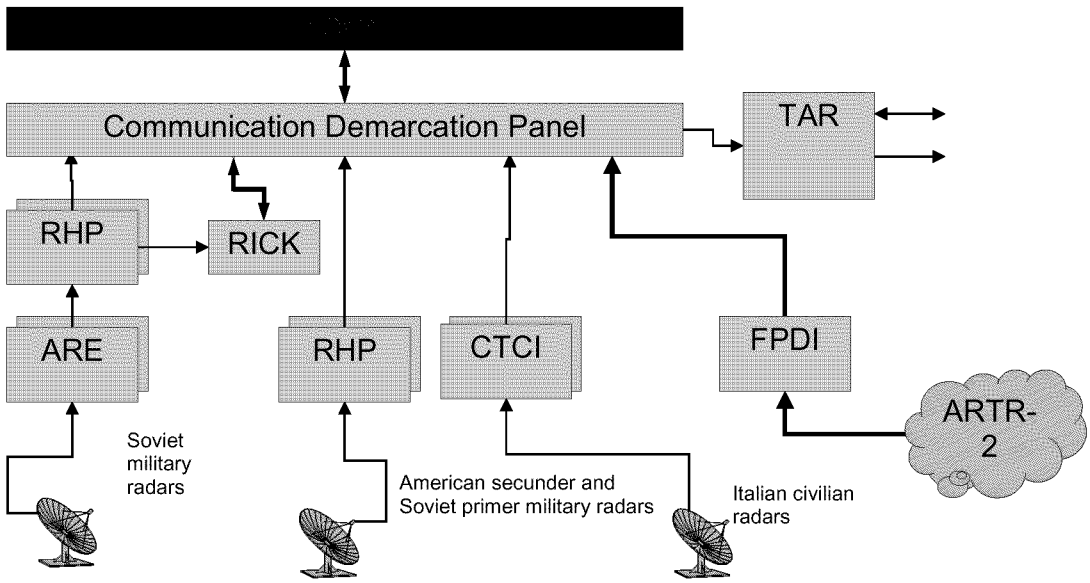
Providing the communication with common protocol

We signed a contract with Hungarian developer enterprises according to the Public Purchase Law.
These were the seven developing tasks:

1. ARE - Automatic Radar Extractor (converter that makes digital sign from the radar video sign)
2. RHP - Radar head processor (tracker instrument)
3. RICK - Radar Information Collecting and Processing Sub-centre
4. FPDI - Flight Plan Data Interface
5. CTCI - Civil Air Traffic Radar Data Control Interface
6. KRI - Communication System Interface
7. TAR - Information Sub-centre

The Hungarian developed air traffic control system connected to ASOC is finished. Under the control of the Ministry of Defense Institute of the Military Technology the Hungarian companies designed, manufactured and measured the necessary hardware and software. The system has been installed at 14 locations according the contracts. Field test started at 1998 August and finished in 1998 October, parallel with the American partner installed the ASOC centre at Veszprém. The final application program's installation and integration to the national air sovereignty control system was carried out in 1998 August. American made ASOC center and the Hungarian information system in use for military service from the fourth quarter of 1998. The system transmitted the radar (military and civil, primer and secondary) information automatically to ASOC in real time.

5 Essential components of the system



5.1 Automatic radar extractor (ARE)

It is a basic part connected to the Hungarian Air Sovereignty Operations Center by means of Radar head processor (RHP). By digitising and transmitting the positions of flying objects in the air it gives the primary military radar information to the ASOC.

5.2 Radar head processor (RHP)

The function of the RHP (tracker computer) acceps secondary radar plots and the primary plots coming from Hughes primary radar extractor. The RHP accepts military radar plots processed by the ARE at air sovereignty control sites where there is no IFF device. The RHP makes tracks from the primary and secondary plots and unifies the tracks belonging to the same target (correlation). The device sends the secondary plot directly to the ASOC. One can make a choice between the transmission primary plots directly to the ASOC or send track transmission to the "Radar Information Gathering and Processing Subcenter" (RICK).

5.3 Radar Information Gathering and Processing Subcenter (RICK)

It supplies the ASOC system with qualified radar (track) information. It is suited to work out integrated air traffic picture based on RHP track data. Operators are able to provide manual or automatic aircraft's identification. It supports computer-aided control and identification of civil public flights.

5.4 Flight Planing Data Interface (FPDI)

It provides the flight plan data from "Automated flight planning system" (ARTR-II) to ASOC in a protocol defined in the "ASOC -Interface Design Document" (IDD).

5.5 Civil Air Traffic Radar DATA Control Interface (CTCI)

The CTCIs function is the transmission of three digitised civil radar data to the ASOC. It is also a radar source for ASOC to the creation the continuous real-time air traffic picture.

The second function of the CTCI is the conversion of the radar information from coming the protocol defined MATIAS Interface Control Document (ICD) (ALENIA HDLC protocol, ASTERIX form) to the protocol defined in the "ASOC ICD".

5.6 Communication System Interface with the Demarcation Panel (KRI)

It provides the communication of the national developed information system, to the data transfer from Hungarian information sources to the demarcation panel. The communication system provides data exchange between the national information sources (Radar Head Processors, civilian radar's, Radar Information Gathering and Processing Subcenter) and Hungarian ASOC using "Radar Data Multifunction Transmission" (RAMA-2) protocol. It also provides data exchange between foreign information sources (neighbouring ASOCs, NATO centres, military radar information of neighbouring countries) and Hungarian ASOC. It provides the protocol checking of communication and physical connection capability for the information system as well.

5.7 Information Subsystem (TAR)

At the Operations Centre of Air Force Staff the ASOC air traffic picture is distributed from the ASOC output, and is sent target designation to fighters and air defence missile troops' headquarters by TAR.

6 ASOC tasks

The ASOC is an air-picture displaying system based on the radar data of home digital or digitised 2D or 3D radars. The system-input sources reviewed previously. We had to do the fitting of the data transmission protocol at input sources in all cases. Furthermore the Link-1 connection was important, which through we can be in contact with the airspace control centre of NATO. The ASOC has to take over the former obsolete manual displaying and controlling. The system is capable of providing the airspace control at peacetime, however it gives an opportunity of the later enlargement by defense functions.

7 Strategy of project

When Institute of Military Technology started the project two things were clear: we had extremely short deadline and very low available material founds. To solve the problem we worked very hard. We decided to use all results we reached in the last five years in this field, and built up modular system.. At the end approximately 80% of all systems was built up in commercial components. We used PC-s (dual pentium II 266Mhz), Windows NT 4.0 operating system and Visual C++ developer system.

8 Operating experience

The nation-wide system has been working for 2 years. The system consists of more than 20 PC-s, and operates for 24 hours/day.

There were 19 hardware and 8 software failure in this year.

Most of the problems were caused by the uninterruptible power source.

Least of the problems were caused by the monitors. Monitor problem occurred only once in two years.

The ASOC system with the domestic developed input and output equipment change the obsolete airspace control system. Nowadays it is

impossible to control the huge amount of aircrafts crossing our airspace.

The problems have been solved by the real time digital equipment. The reliability of the system is determined by reliability of our radars and communication lines, therefore we have to improve the system at these fields.

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